NAME: CLASS PERIOD: DATE:

IS DILUTION THE SOLUTION?

Background Information

Scientists who analyze air quality measure the amounts of pollutants found within a given volume of air. This proportion is expressed in parts per million (ppm). For example, in a volume of air containing 1 million molecules, a certain number may be carbon monoxide (CO) molecules. If 50 molecules of CO are detected in a volume of air containing 1 million molecules, the CO reading would be 50 parts per million by volume.

In this investigation you will determine how to measure the concentration of a liquid in parts per million.

Problem *(fill in problem):* _____

_____

Materials

one pipette or eyedropper
one white ice cube tray or plastic egg carton
one stirrer
water
permanent marker
2 cups
food coloring (blue or red)

Procedure

1. Number ice tray or egg carton wells from 1-6.
2. Fill one cup with water. This will be used to rinse the pipette after each use.
3. Carefully place 10 drops of food coloring in well #1.
4. Remove one drop of food coloring from well #1 with the pipette and place it in well #2.
5. Fill the pipette with water from the cup and discard in the empty cup. Repeat until the pipette is clean. Refill water cup with clean water.
6. Add nine drops of clean water to well #2.
7. With the pipette, take one drop of solution from well #2 and add it to well #3.
8. Rinse the dropper in the cup of water using the same procedure as in step 5.
9. Next, add nine drops of clean water to well #3 and mix.
10. With the pipette, take one drop of solution from well #3 and add it to well #4.
11. Rinse the dropper in the cup of water using the same procedure as in step 5.

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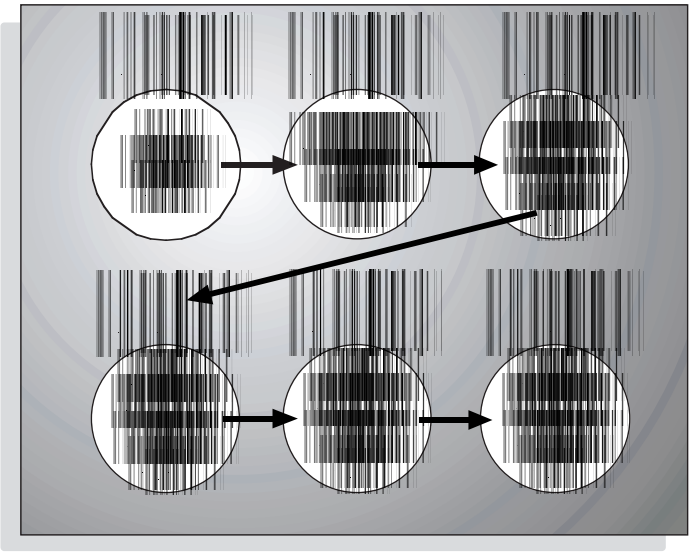
IS DILUTION THE SOLUTION? INVESTIGATION (CONT.)



12. Next, add nine drops of clean water to well #4 and mix.
13. With the pipette, take one drop of solution from well #4 and add it to well #5.
14. Rinse the dropper in the cup of water using the same procedure as in step #5.
15. Next, add nine drops of clean water to well #5 and mix.
16. With the pipette, take one drop of solution from well #5 and add it to well #6
17. Rinse the dropper in the cup of water using the same procedure as in step #5.

Observations

1. In which wells can you easily see the colors? _____

2. In which wells do you not see the colors? _____
3. Food coloring is usually packaged as a 10 percent solution or a 1/10 dilution (1 in 10 dilution). Therefore, the dilution in well #1 is 1/10. What dilution occurred in well #2 when 9 drops of water were added to one drop of the colored water from well #1? _____

4. In well #3 the dilution was _____

5. In well #4 the dilution was _____

6. In well #5 the dilution was _____

7. In well #6 the dilution was _____

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IS DILUTION THE SOLUTION?
INVESTIGATION (CONT.)

Conclusion

1. How does the dilution of food coloring in water relate to air quality testing?

_____

_____

Application

1. How many liters of water would you need to have to create a solution of 1 ppm using 1 ml of food coloring?_____

   Hint: 1 ml food-coloring solution @ 0.1 concentration = 0.1 ml food coloring

2. How much more dilute than 1 ppm is the U.S. Environmental Protection Agency's 0.12 ppm standard for ozone? _____

3. Substances called air toxics, such as benzene, a component of gasoline, are sometimes measured in parts per billion because they are dangerous in extremely small quantities. If we used one milliliter of food coloring to represent 1ppb, how much water would we have to have?

_____

Going further

1. Is diluting a substance for disposal in our waterways a valid solution? Why or why not?

_____

_____

2. What is the relationship between diluting substances for disposal in our waterways and air pollution? _____

_____